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IS 15885-2-3 (2011): SAFETY OF LAMP CONTROLGEAR, Part 2: PARTICULAR REQUIREMENTS, Section 3: ac Supplied Electronic Ballasts for Fluorescent Lamps [ETD 23: Electric Lamps and their Auxiliaries]

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Indian Standard

SAFETY OF LAMP CONTROLGEAR

PART 2 PARTICULAR REQUIREMENTS

Section 3 ac Supplied Electronic Ballasts for Fluorescent Lamps

ICS 29.140.99

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

May 2011 **Price Group 5**

Electric Lamps and Their Auxiliaries Sectional Committee, ETD 23

FOREWORD

This Indian Standard (Part 2/Sec 3) was adopted by the Bureau of Indian Standards, after the draft finalized by the Electric Lamps and Their Auxiliaries Sectional Committee had been approved by the Electrotechnical Division Council.

This standard published in conjunction with IS 15885 (Part 1). The formatting into separately published parts provides for ease of future amendments and revisions. Additional requirements will be added as and when a need for them is recognized.

In referring to any of the clauses of IS 15885 (Part 1), specifies the extent to which such a clause is applicable and the order in which the tests are to be performed; they also include additional requirements, as necessary. All parts which make up Part 2 and their sections are self-contained and, therefore, do not include references to each other.

Where the requirements of any of the clauses of IS 15885 (Part 1) are referred to in this standard by the phrase 'The requirements of clause '*n*' of IS 15885 (Part 1) apply', this phrase is interpreted as meaning that all requirements of the clause in question of part 1 apply, except any which are clearly inapplicable to the specific type of lamp controlgear covered by this particular part of IS 15885 (Part 2/Sec 3).

Clauses/tables which are additional to those of Part 1 of this standard are numbered starting from **101** and additional sub-clauses are numbered with the main clauses number followed by **101**, **102** etc, for example **7.101**.

Annexes A to K form an integral part of this standard.

This standard is published in eleven sections. Other sections are:

Section 1	Starting devices (other than glow starters)
Section 2	dc or ac supplied electronic step-down convertors for filament lamps
Section 4	dc electronic ballasts for general lighting
Section 5	dc supplied electronic ballasts for public transport lighting
Section 6	dc supplied electronic ballasts for aircraft lighting
Section 7	dc supplied electronic ballasts for emergency lighting
Section 8	Ballasts for fluorescent lamps
Section 9	Ballasts for discharge lamps (excluding fluorescent lamps)
Section 10	Electronic invertors and convertors for high-frequency operation of cold start tubular discharge lamps (neon tubes)
Section 11	Miscellaneous electronic circuits used with luminaires.

Indian Standards in respect of Part 2/Sections 2, 4, 5, 6, 7, 10 and 11 will be in future depending upon the need.

This standard is based on IEC 61347-2-3 (2004) 'Lamp controlgear — Part 2-3: Particular requirements for ac supplied electronic ballasts for fluorescent lamps' issued by the International Electrotechnical Commission.

The safety requirement of ac supplied electronic ballast for fluorescent lamps was covered under IS 13021 (Part 1) : 1991 'ac supplied electronic ballasts for tubular fluorescent lamps: Part 1 General and safety requirements'. Since safety requirements of all types of lamp controlgear including ballasts for fluorescent lamps have been covered under a new series, IS 13021(Part 2) : 1991 'ac supplied electronic ballasts for tubular fluorescent lamps: Part 2 Performance requirements' would accordingly be revised to cover only performance requirements. With the publication of this standard, IS 13021 (Part 1) : 1991 shall be treated as withdrawn.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SAFETY OF LAMP CONTROLGEAR

PART 2 PARTICULAR REQUIREMENTS

Section 3 ac Supplied Electronic Ballasts for Fluorescent Lamps

1 SCOPE

This standard (Part 2/Sec 3) specifies particular safety requirements for electronic ballasts for use on ac supplies up to 1 000 V at 50 Hz with operating frequencies deviating from the supply frequency, associated with fluorescent lamps as specified in IS 2418 (Part 1) and IS 15687 (Part 2) and other fluorescent lamps for high-frequency operation.

Particular requirements for electronic ballasts with means of protection against overheating are given in Annex C.

Particular requirements for ac/dc supplied electronic ballasts for maintained emergency lighting are given in Annex K.

Performance requirements are covered in IS 13021 (Part 2).

2 REFERENCES

Following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
2418	Tubular fluorescent lamps for general lighting service:
(Part 1) : 1977	Requirements and tests (*first revision*)
(Part 2) : 1977	Standard lamp data sheet (*first revision*)
9853 : 1981	Emergency lighting units
13021 (Part 2) : 1991	ac supplied electronic ballast for tubular fluroscent lamps: Part 2 Performance requirements
15885 (Part 1) : 2011	Safety of lamp controlgear: Part 1 General requirements
15687 (Part 2)	Single-capped fluorescent lamps: Part 2 Performance requirements (*under preparation*)

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 15885 (Part 1) and the following shall apply.

3.1 ac Supplied Electronic Ballast — Mains-supplied ac to ac inverter including stabilizing elements for starting and operating one or more tubular fluorescent lamps, generally at high frequency.

3.2 Controllable Ballast — Lamp power (light output) of the electronic ballast controlled between the minimum value (or off) and the maximum value by the signal on the control input of the ballast.

3.3 Maximum Value of Lamp Power (of Controllable Ballast) — Lamp power (light output) which complies with **8.1** of IS 13021 (Part 2), unless otherwise declared by the manufacturer or responsible vendor.

3.4 Maximum Allowed Peak Voltage — Highest permitted peak voltage across any insulation under open-circuit condition and any normal and abnormal operating conditions. The maximum peak voltage is related to the declared r.m.s. working voltage (*see* Table 1).

3.5 Minimum Value of Lamp Power (of a Controllable Ballast) — Lowest percentage of the lamp power defined in **3.3** declared by the manufacturer or responsible vendor.

3.6 Control Terminals — Connection to the electronic ballast which are used to apply a control signal for changing the light output.

3.7 Control Signal — Signal which may be an ac or dc voltage, and which by analogue, digital or other means may be modulated to convey the necessary information to the ballast for the purpose of changing the light output.

3.8 ac/dc Supplied Electronic Ballast for Maintained Emergency Lighting — Mains/battery-supplied ac/dc to ac inverter including stabilizing elements for starting and operating one or more tubular fluorescent lamps, generally at high frequency for emergency lighting.

3.9 Cathode Dummy Resistor — Cathode substitution resistor as specified on the relevant lamp data sheet of IS 2418 (Part 1) or IS 15687 (Part 2) or as declared by the relevant lamp manufacturer or by the responsible vendor.

NOTE — The power supply terminal can also act as control terminals.

4 GENERAL REQUIREMENTS

The requirements of IS 15885 (Part 1) shall apply, together with the following additional requirement:

> ac/dc electronic ballasts for emergency lighting shall comply with the requirements of Annex K.

5 GENERAL NOTES ON TESTS

The requirements of **5** of IS 15885 (Part 1) apply together with the following additional requirement:

Number of Specimens

The following number of specimens shall be submitted for testing:

a) One unit for the tests of **6** to **12** and **15** to **21**; and
b) One unit for the test of **14** (additional units or components, where necessary, may be required in consultation with the manufacturer).

Tests to meet the safety requirements for ac/dc supplied electronic ballasts for emergency lighting are made under the conditions specified in Annex K.

6 CLASSIFICATION

The requirement of IS 15885 (Part 1) shall apply.

7 MARKING

Ballasts which form an integral part of the luminaire need not be marked.

7.1 Mandatory Markings

In accordance with the requirements of **7.2** of IS 15885 (Part 1), ballasts, other than integral ballasts, shall be clearly and durably marked with the following mandatory markings:

a) **7.1** (a), (b), (c), (d), (e), (j) and (k) of IS 15885 (Part 1), together with;
b) Symbol for earthing, as applicable;
c) For controllable ballasts, the control terminals shall be identified;
d) A declaration of the maximum working voltage (rms) according to **12.2** between
e) Output terminals; and
f) Any output terminal and earth, if applicable.

Marking for each of these two values shall be in steps of 10 V when the working voltage is equal to, or less than, 500 V, and in steps of 50 V when the working voltage is higher than 500 V. The marking or maximum voltage is referenced in two situations, the maximum between output terminals and the maximum between any output terminal and earth. It is acceptable for only the higher of these two voltages to be marked. Marking shall be U-OUT = …V.

7.2 Information to be Provided, if Applicable

In addition to the above mandatory markings, the following information, if applicable, shall be given either on the ballast, or be made available in the manufacturer's catalogue or similar:

> **7.1** (h), (j), and (k) given in IS 15885 (Part 1).

Additional Sub-clauses

7.101 The controlgears may also be marked with the Standard Mark.

7.101.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Regulations made thereunder. The details of conditions under which a license for the use of the Standard Mark may be granted to the manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 PROTECTION AGAINST ACCIDENTAL CONTACT WITH LIVE PARTS

The requirements of **10** of IS 15885 (Part 1) shall apply.

9 TERMINALS

The requirements of **8** of IS 15885 (Part 1) shall apply.

10 PROVISIONS FOR EARTHING

The requirements of **9** of IS 15885 (Part 1) shall apply.

11 MOISTURE RESISTANCE AND INSULATION

The requirements of **11** of IS 15885 (Part 1) apply together with the following additional requirements:

> The leakage current that may occur from contact with fluorescent lamps operated at high frequency form ac supplied electronic ballasts shall no exceed the values in Fig. 2 when measured in accordance with Annex J. The value is in rms values.
>
> The limits of leakage current values of frequencies between the values shown in Fig. 2 should be obtained by calculation according to the formula given in Fig. 2 (under consideration).
>
> Compliance with these requirements is checked in accordance with Annex J.
>
> NOTE — Limits of leakage current values for frequencies above 50 Hz are under consideration.

12 ELECTRIC STRENGTH

The requirements of **12** of IS 15885 (Part 1) shall apply.

13 THERMAL ENDURANCE TEST FOR WINDINGS

The requirements of **13** of IS 15885 (Part 1) do not apply.

14 FAULT CONDITIONS

The requirements of **14** of IS 15885 (Part 1) shall apply.

15 PROTECTION OF ASSOCIATED COMPONENTS

15.1 Under conditions of normal operation, verified with dummy cathode resistors inserted and conditions of abnormal operation, as specified in **16**, the voltage at the output terminals shall at no time exceed the maximum permitted peak value specified in Table 1.

Table 1 Relation Between rms Working Voltage and Maximum Peak Voltage

(*Clauses* 3.4 *and* 15.1)

Sl No.	Voltage at Output Terminals	
	rms Working Voltage V	Maximum Permitted Peak Voltage V
(1)	(2)	(3)
i)	250	2 200
ii)	500	2 900
iii)	750	3 100
iv)	1 000	3 200

NOTE — Linear interpolation between the given voltage steps is allowed.

15.2 Under normal operating conditions and abnormal operating conditions as specified in **15**, except for the rectifying effect, and from 5 s after the switch on or beginning of the starting process, the voltage at the output terminal shall not exceed the maximum working voltage for which the ballast is declared.

15.3 In the case of a rectifying effect, that is, abnormal operating condition according to **16**(d), the rms voltage at the output terminal shall not exceed the maximum permitted value for which the ballast is designed for a period longer than 30 s after switch-on, or beginning of the starting process.

For ballasts which make more than one attempt to start a failed lamp, the combined duration of voltage above the maximum working voltage for which the ballast is declared shall not exceed 30 s.

15.4 For the test of **15.1, 15.2**, and **15.3**, the output voltages measured shall be those between any output terminal and earth. Additionally, voltages that appear between output terminals shall be measured in cases where the voltage is present across insulation barriers within associated components.

15.5 For controllable electronic ballasts, the control input shall be isolated from the mains circuit by isolation at least equal to basic insulation.

NOTE — The requirement does not apply to those ballasts where control signals are injected via the supply terminals or where the control signals are completely isolated from the ballast by being transmitted remotely from infra-red or radio wave transmitters.

If SELV is to be used, then double or reinforced insulation is required.

16 ABNORMAL CONDITIONS

The ballast shall not impair safety when operated under abnormal condition at any voltage between 90 percent and 110 percent of the rated supply voltage.

Compliance is checked by the following test.

Each of the following conditions shall be applied with the ballast operating according to the manufacturer's instructions (including a heat sink, if specified) for 1 h:

a) Lamp or one of the lamp is not inserted;
b) Lamp does not start because one of the cathodes is broken;
c) Lamp does not start although the cathode circuit are intact (de-activated lamp);
d) Lamp operates, but one of the cathodes is de-activated or broken (rectifying effects); and
e) Short circuits of the starter switch, if any.

For the test simulating operation with a de-activated lamp, a register is connected in place of each lamp cathode. The register value is derived from the value of the nominal running current of the lamp prescribed in the relevant lamp data sheet of IS 2418 (Part 2) and IS 15687 (Part 2) and substituted in the following equation:

$$R = \frac{11.0}{2.1 \times l\mathrm{n}} \Omega$$

where

l_{n} = nominal running current of the lamp.

For lamp not covered by IS 2418 (Part 1) and IS 15687 (Part 2), the values declared by the lamp manufacturer shall be used.

When testing electronic ballasts for the rectifying effect, the circuit shown in Fig. 1 is used. The lamp is connected to the mid-points of the appropriate equivalent resisters. The rectifier polarity is chosen so as to give the most unfavourable conditions. If necessary, the lamp is started using a suitable device.

During and at the end of the tests specified under items (a) to (e), the ballasts shall show neither defect impairing safety nor any smoke is produced.

17 CONSTRUCTION

The requirements of **15** of IS 15885 (Part 1) do not apply.

18 CREEPAGE DISTANCES AND CLEARANCES

The requirements of **16** of IS 15885 (Part 1) shall apply.

19 SCREWS, CURRENT-CARRYING PARTS AND CONNECTIONS

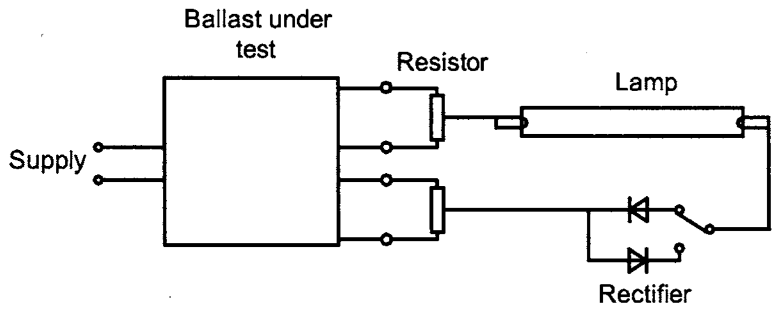
The requirements of **17** of IS 15885 (Part 1) shall apply.

20 RESISTANCE TO HEAT, FIRE AND TRACKING

The requirements of **18** of IS 15885 (Part 1) shall apply.

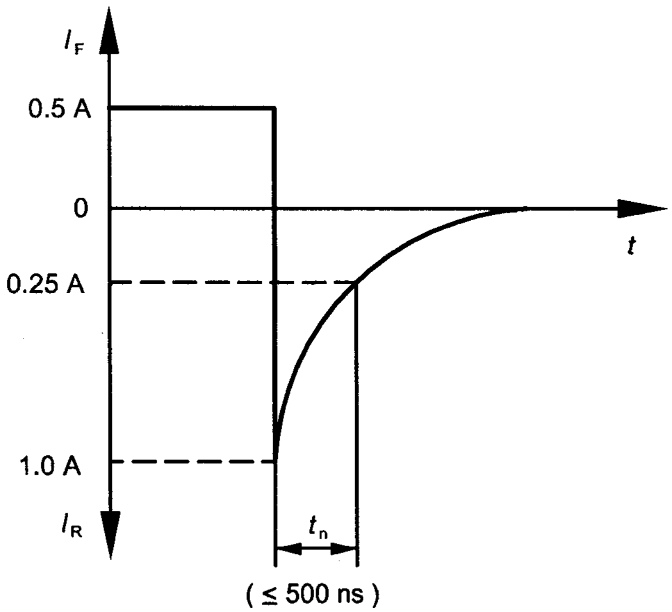
21 RESISTANCE TO CORROSION

The requirements of **19** of IS 15885 (Part 1) shall apply.



The rectifier characteristics shall be:

Peak inverse voltage	U_{RRM}	≥	3 000 V
Reverse leakage current	I_R	≤	10 µA
Forward current	I_F	≥	three times nominal lamp running current
Reverse recovery time	t_{IT}	≤	500 ns
(maximum frequency: 150 kHz)			(measured with I_F = 0.5 A and I_R = 1 A to I_R = 0.25 A)



NOTE — The following types of diodes (three diodes in series) are recommended as a suitable rectifier: RGP 30 M, BYM 96 E, BYV 16.

FIG. 1 CIRCUIT FOR TESTING RECTIFYING EFFECT

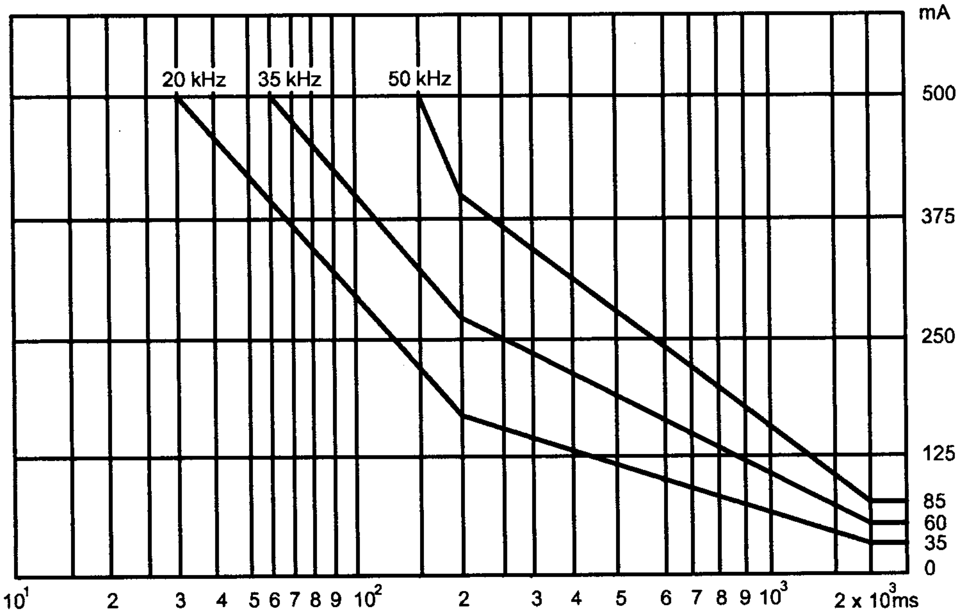


FIG. 2 LIMITS FOR CAPACITIVE LEAKAGE CURRENT IN rms OF HF-OPERATED TUBULAR FLUORESCENT LAMPS DEPENDING ON DURATION

ANNEX A

(*Foreword*)

TEST IS ESTABLISH WHETHER A CONDUCTIVE PART IS A LIVE PART WHICH MAY CAUSE AN ELECTRIC SHOCK

The requirements of Annex A of IS 15885 (Part 1) shall apply.

ANNEX B

(*Foreword*)

PARTICULAR REQUIREMENTS FOR THERMALLY PROTECTED LAMP CONTROLGEAR

The requirements of Annex B of IS 15885 (Part 1) are not applicable.

ANNEX C

(*Foreword* and *Clause* 1)

PARTICULAR REQUIREMENTS FOR ELECTRONIC LAMP CONTROLGEAR WITH MEANS OF PROTECTION AGAINST OVERHEATING

The requirements of Annex C of IS 15885 (Part 1) shall apply.

ANNEX D

(*Foreword*)

REQUIREMENTS FOR CARRYING OUT HEATING TESTS OF THERMALLY PROTECTED LAMP CONTROLGEAR BALLASTS

The requirements of Annex D of IS 15885 (Part 1) shall apply.

ANNEX E

(*Foreword*)

USE OF CONSTANT S OTHER THAN 4 500 IN t_W TESTS

The requirements of Annex E of IS 15885 (Part 1) are not applicable.

ANNEX F

(*Foreword*)

DROUGHT-PROOF ENCLOSURE

The requirements of Annex F of IS 15885 (Part 1) are not applicable.

ANNEX G

(*Foreword*)

EXPLANATION OF THE DERIVATION OF THE VALUES OF PULSE VOLTAGES

The requirements of Annex G of IS 15885 (Part 1) are not applicable.

ANNEX H

(*Foreword*)

TESTS

The requirements of Annex H of IS 15885 (Part 1) are not applicable.

ANNEX J

(*Foreword* and *Clause* 11)

MEASUREMENT OF HIGH-FREQUENCY LEAKAGE CURRENT

J-1 Electronic ballasts are tested for capacitive high-frequency leakage current, as follows:

The ballast is tested in the circuit shown in Fig. 3 with two normal lamps, each being connected to the circuit at only one end ("crossed pair of lamps"). This method would also provide the worst-case leakage to earth.

The glass tube of one of the two lamps, whichever gives the worst value, is wrapped with a 75 mm wide metal foil, together with a non-inductive 2 000 Ω register and a measuring device suitable for the test circuit.

The test shall be conducted with the lamps supported on two 75 mm high wooden blocks and placed on a wooden table, such that no external influence from metallic surfaces is caused.

The leakage current (that is, the high-frequency current flowing from the metal foil through the 2 000 Ω register to earth) is measured under the following simulated operating conditions.

a) Two normal lamps, each being inserted at only one end into a pair of holders, with the supply voltage switched on.
b) In order to take care of the most adverse condition (that is, to ensure that the highest leakage current which may occur will be measured) the procedure shall be carried out in such a way that all of the four possible holder contact/cap-pin combinations are covered.
c) For ballasts with multi-lamp operation, the leakage current from each lamp position is measured separately.
d) Where a range of ballasts are submitted for test, each ballast type shall be checked, not just the higher or lower power variants.
e) Under each of the specified operation conditions, the capacitive leakage current measured shall not exceed the limits specified in Fig. 2.

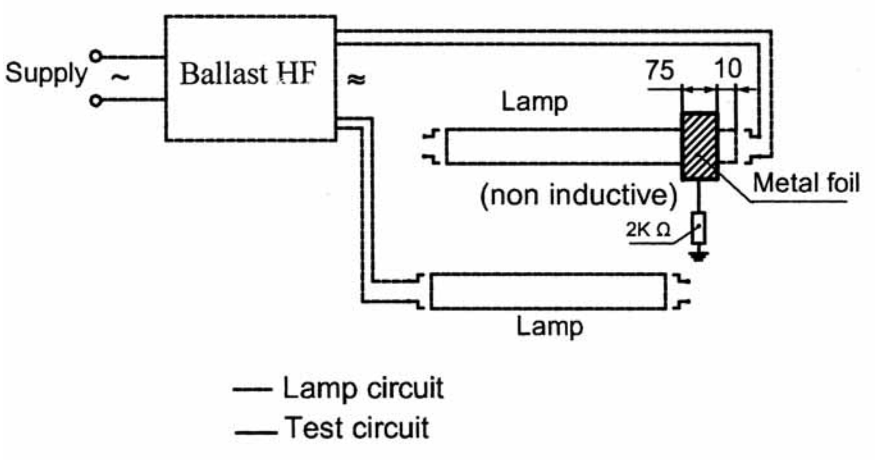


FIG. 3 TEST ARRANGEMENT

ANNEX K

(*Foreword* and *Clauses* 1, 4 *and* 5)

PARTICULAR ADDITIONAL SAFETY REQUIREMENTS FOR ac/dc SUPPLIED ELECTRONIC BALLASTS FOR EMERGENCY LIGHTING

K-1 SCOPE

This Annex specifies particular safety requirement of ac/dc supplied electronic ballasts for maintained emergency lighting purpose as well as specific requirements, as specified in IS 9583.

It applies to ac/dc supplied electronic ballasts for maintained emergency lighting not including batteries which are intended for connection to an emergency power supply. This can be a central battery supply system.

It does not apply to ballasts used in self-contained emergency lighting luminaries.

This Annex also includes the operational requirements applicable to electronic ballasts operating on an ac supply in the emergency mode.

K-2 TERMINOLOGY

The definitions in **3** of apply together with the following:

K-2.1 Emergency Lighting — Lighting provided for use when the supply to the normal lighting fails; it includes escape lighting and standby lighting.

K-2.2 Maintained Emergency Lighting — Lighting provided when normal and emergency lighting is required.

K-2.3 ac/dc Maintained Emergency Lighting Operation Ballast — Ballast for operating a lamp forms the normal lighting supply with normal switching and also form the emergency lighting supply when failure of the normal lighting supply occurs.

K-2.4 Rated Battery Voltage — Voltage declared by the battery manufacturer.

K-2.5 Rated Emergency Power Supply Voltage — Rated voltage of the emergency power supply claimed by the manufacturer for the information of the installer or user.

K-2.6 Starting Aid — Device which facilitates the starting of the lamp.

NOTE — A conductive strip affixed to the outer surface of the lamp and a conductive plate which is spaced within an appropriate distance from a lamp are examples of starting aids.

K-2.7 Ballast Lumen Factor — Ratio of the luminous flux of a reference lamp when the ballast under test is operated at its rated voltage and frequency compared with the luminous flux of the same lamp operated with the appropriate reference ballast supplied at its rated voltage and frequency.

K-2.8 Reference Ballast — Special ballast designed for the purpose of providing comparison standards for use in testing ballasts, for the selection of reference lamps and for testing regular production lamps under standardized condition; essentially characterized by the fact that at its rated frequency, it has a stable voltage/current ration relatively uninfluenced by variations in current, temperature and magnetic surroundings as outlined in the relevant ballast standard.

K-2.9 Reference Lamp — Discharge lamp selected for the purpose of testing ballasts and which, when associated with a reference ballast under specified conditions, ahs electrical values which are close to the rates specified in the relevant lamp standard or assigned by the manufacturer or responsible vendor for the particular lamp.

K-2.10 Calibration Current of a Reference Ballast — Value of the current on which the calibration and control of the ballast are based.

K-2.11 Total Circuit Power — Total power dissipated by ballast and lamp in combination, at rated voltage and frequency of the ballast.

K-2.12 Preheat Starting — Type of circuit in which the lamp electrodes are brought to emission temperature before the lamp actually ignites.

K-2.13 Non-preheat Starting — Type of circuit which utilizes a high open-circuit voltage causing field emission from electrodes.

K-2.14 Pre-start Time — For ballasts according to **K-2.12**, period after switching on the supply voltage during which the lamp current is ≤ 10 mA.

K-3 MARKING

K-3.1 Mandatory Marking

Ballast shall, in addition to the requirements of **7.1**, be clearly marked with the following mandatory marking:

a) ac/dc maintained emergency lighting operation ballast (symbol under consideration); and
b) Rated emergency power supply voltage and voltage range.

K-3.2 Information to be Provided, if Applicable

In addition to the above mandatory markings and the requirements of **7.2**, the following information shall either be given on the ballast or be made available in the manufacturer's catalogue or similar:

a) A clear indication regarding the type of starting, that is preheat or non-preheat;
b) Indication whether a starting aid is needed for the lamp(s);
c) Limits of the ambient temperature range within which an independent ballast will operate satisfactorily at the declared voltage (range); and
d) Ballast lumen factor in the emergency operation mode.

K-4 GENERAL STATEMENT

The provisions of **6** of IS 13021 (Part 2) shall apply at 90 percent and 110 percent of the rated emergency power supply voltage.

Furthermore, starting and operation of lamps shall be guaranteed across the widest rated dc voltage range due to the highest and lowest battery voltages.

NOTES

1 The electrical characteristics, as given on the lamp data sheets of IS 2418 (Part 2) and IS 15687 (Part 2), and applying to operation on reference ballast at rated voltage with a frequency of 50 Hz may deviate when operating on high-frequency ballast and the conditions of item (c) of **K-3.2**.

2 A starting aid is only effective when it has an adequate potential difference form one end of the lamp.

K-5 STARTING CONDITIONS

The provisions of **7** of IS 13021 (Part 2) shall apply. In addition, tests shall be made with rated dc supply voltage, and where the highest or lowest ac voltage limits are given, tests shall be made with ±10 percent dc voltage, respectively.

K-6 OPERATING CONDITIONS

The provisions of **8** of IS 13021 (Part 2) shall apply. In addition tests shall be made with rated dc supply voltage.

K-7 SUPPLY CURRENT

The provisions of **10** of IS 13021(Part 2) shall apply.

K-8 MAXIMUM CURRENT IN ANY LEAD TO A CATHODE

The provisions of **11** of IS 13021 (Part 2) shall apply. In addition, tests shall be made with rated dc supply voltage, and where highest or lowest ac voltage limits are given, tests shall be made with ±10 percent dc voltage, respectively.

K-9 LAMP OPERATING CURRENT WAVEFORM

The provisions of **12.2** of IS 13021 (Part 2) shall apply. In addition, tests shall be made with rated dc supply voltage.

K-10 MAINS TRANSIENT OVERVOLTAGES

The provisions of **15** of IS 13021 (Part 2) shall apply.

K-11 PULSE VOLTAGE FROM CENTRAL BATTERY SYSTEMS

NOTE — This pulse voltage is under consideration.

The ballast shall withstand, without failure, any pulses caused by switching other equipment in the same circuit.

Compliance is checked by operating the ballast at the maximum voltage of the rated voltage range in association with the appropriate number of lamps and in an ambient temperature of 25°C. The ballast shall withstand, without failure, the number of pulse voltages given in Table 2 superimposed, with the same polarity, on the supply voltage.

Table 2 Pulse Voltages

Sl No.	Number of Voltage Pulses	Pulse Voltage		Period Between Each Pulse
		Peak Value V	Pulse Width at Half Peak ms	s
(1)	(2)	(3)	(4)	(5)
i)	3	Equal to design voltage	10	2

NOTE — A suitable measuring circuit is shown in Fig. 6 of IS 15885 (Part 1).

K-12 TESTS FOR ABNORMAL CONDITIONS

The provisions of **16** of this standard and **16.1** and **16.2** of IS 13021(Part 2) shall apply. In addition, the tests shall be made with ± 20 percent rated dc supply voltage.

K-13 TEMPERATURE CYCLING TEST AND ENDURANCE TEST

The provisions of **25** of IS 15885 (Part 1) shall apply. The tests shall be made with dc supply voltage.

Bureau of Indian Standards

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Review of Indian Standards

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This Indian Standard has been developed from Doc No.: ETD 23 (5719).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

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